

Application No. 10/648,522
Reply to Office Action of March 18, 2008

IN THE CLAIMS

Please amend the claims as follows:

1-11. (Canceled)

12. (Currently Amended) ~~The digital watermark analysis apparatus according to claim 10,~~ A digital watermark analysis apparatus for specifying at least one of a plurality of identification information items embedded as a plurality of watermark information items in a plurality of legal copies of digital contents used for collusive attacks, from a plurality of illegal copies of the digital contents obtained by collusive attacks made against the legal copies, the digital watermark analysis apparatus comprising:

an extraction unit configured to extract a plurality of embedded codes including ranks from the illegal copies, each of the ranks being uniquely numbered among each of the embedded codes;

an acquisition unit configured to acquire a plurality of symbols corresponding to the embedded codes and arrange the symbols in accordance with the ranks of the embedded codes, and acquire a first symbol sequence of symbol sequences each of which includes a plurality of the symbols; and

a specifying unit configured to specify at least one of the identification information items embedded in the legal copies, based on a plurality of second symbol sequences uniquely assigned to the identification information items and the first symbol sequence,

wherein the extraction unit extracts, in units of the ranks, one of the embedded codes corresponding to the symbols, the one of the embedded codes being estimated to be most frequently used in the collusive attacks.

13. (Canceled)

14. (Currently Amended) ~~The digital watermark analysis apparatus according to~~
~~claim 13, A digital watermark analysis apparatus for specifying at least one of a plurality of~~
~~identification information items embedded as a plurality of watermark information items in a~~
~~plurality of legal copies of digital contents used for collusive attacks, from a plurality of~~
~~illegal copies of the digital contents obtained by collusive attacks made against the legal~~
~~copies, the digital watermark analysis apparatus comprising:~~

an extraction unit configured to extract a plurality of embedded codes including ranks
from the illegal copies, each of the ranks being uniquely numbered among each of the
embedded codes;

an acquisition unit configured to acquire a plurality of symbols corresponding to the
embedded codes and arrange the symbols in accordance with the ranks of the embedded
codes, and acquire a first symbol sequence of symbol sequences each of which includes a
plurality of the symbols; and

a specifying unit configured to specify at least one of the identification information
items embedded in the legal copies, based on a plurality of second symbol sequences
uniquely assigned to the identification information items and the first symbol sequence,

wherein the extraction unit extracts several of the embedded codes which are
generated in a random number sequence such that the embedded codes corresponding to the
symbols including a same rank in the symbol sequences include one of no cross-correlation
and a very low cross-correlation;

the extraction unit obtains, in units of the ranks, cross-correlation between embedded
codes corresponding to the symbols contained in the first symbol sequence, and obtains one
of the embedded codes which includes a maximum cross-correlation; and

~~wherein~~ the extraction unit extracts several of the embedded codes which are generated in a random number sequence such that the embedded codes corresponding to the symbols differing in each of the ranks in the symbol sequences include one of no cross-correlation and a very low cross-correlation.

15. (Currently Amended) ~~The digital watermark analysis apparatus according to claim 10;~~ A digital watermark analysis apparatus for specifying at least one of a plurality of identification information items embedded as a plurality of watermark information items in a plurality of legal copies of digital contents used for collusive attacks, from a plurality of illegal copies of the digital contents obtained by collusive attacks made against the legal copies, the digital watermark analysis apparatus comprising:

an extraction unit configured to extract a plurality of embedded codes including ranks from the illegal copies, each of the ranks being uniquely numbered among each of the embedded codes;

an acquisition unit configured to acquire a plurality of symbols corresponding to the embedded codes and arrange the symbols in accordance with the ranks of the embedded codes, and acquire a first symbol sequence of symbol sequences each of which includes a plurality of the symbols; and

a specifying unit configured to specify at least one of the identification information items embedded in the legal copies, based on a plurality of second symbol sequences uniquely assigned to the identification information items and the first symbol sequence,

wherein the acquisition unit compares the second symbol sequences with third symbol sequences extracted from the illegal copies, and specifies at least one of the identification information items embedded in the legal copies based on comparison results of the acquisition unit.

16. (Original) The digital watermark analysis apparatus according to claim 15, wherein the acquisition unit compares, in units of the ranks, the second symbol sequences with the third symbol sequences, and if the third symbol sequences are identical at the ranks greater than a preset number of the ranks, the identification information items are determined to be those embedded in the legal copies.

17. (Previously Presented) The digital watermark analysis apparatus according to claim 16, wherein

if the identification information items are a plurality of integers, a plurality of particular integers $N(i)$ (i : integer, $N(1) \leq N(2) \leq \dots \leq N(M)$) are preset for each of the ranks i of each of the second symbol sequences, and the extraction unit selects, from a range of $0 \sim N(i)-1$, a symbol $S(i)$ corresponding to each of the ranks i of the second symbol sequences, and arranges the symbol $S(i)$, into a to-be-generated symbol sequence, in accordance with each of the ranks i ,

the preset number is $(k + \ell)$,

where k is a value which makes a product of $N(1), \dots, N(k)$ higher than a total number of the identification information items, and ℓ satisfies $[1 - \prod_{i=1}^{\ell} 1/N(i)]^S \geq 1 - \epsilon_2$ (a range of i that assumes $i = 1 \sim \ell$ or $i = k + 1 \sim (k + \ell)$, $S = M C_{k+\ell}$ and ϵ_2 ($0 < \epsilon_2 < 1$) represents a rate of error tracing at which erroneous identification information is specified as the identification information embedded in the legal copies).

18. (Previously Presented) The digital watermark analysis apparatus according to claim 16, wherein

if the identification information items are a plurality of integers, a plurality of particular integers $N(i)$ (i : integer, $q = N(1) = N(2) = \dots = N(M)$) are preset for each of the ranks i of each of the second symbol sequences, and the extraction unit selects, from a range of $0 \sim N(i)-1$, a symbol $S(i)$ corresponding to each of the ranks i of the second symbol sequences, and arranges the symbol $S(i)$, into a to-be-generated symbol sequence, in accordance with each of the ranks i ,

the predetermined number is $(k + \ell)$, where k is a value which makes a product of $N(1), \dots, N(k)$ higher than a total number of the identification information items, and ℓ satisfies $[1 - 1/q^\ell]^S \geq 1 - \epsilon$, where $S = MC_{k+1}$, and ϵ ($0 < \epsilon < 1$) represents a rate of error tracing at which erroneous identification information is specified as the identification information embedded in the legal copies.

19. (Currently Amended) ~~The digital watermark analysis apparatus according to claim 10;~~ A digital watermark analysis apparatus for specifying at least one of a plurality of identification information items embedded as a plurality of watermark information items in a plurality of legal copies of digital contents used for collusive attacks, from a plurality of illegal copies of the digital contents obtained by collusive attacks made against the legal copies, the digital watermark analysis apparatus comprising:

an extraction unit configured to extract a plurality of embedded codes including ranks from the illegal copies, each of the ranks being uniquely numbered among each of the embedded codes;

an acquisition unit configured to acquire a plurality of symbols corresponding to the embedded codes and arrange the symbols in accordance with the ranks of the embedded codes, and acquire a first symbol sequence of symbol sequences each of which includes a plurality of the symbols; and

a specifying unit configured to specify at least one of the identification information items embedded in the legal copies, based on a plurality of second symbol sequences uniquely assigned to the identification information items and the first symbol sequence,

wherein a maximum number of the legal copies is set to a preset value, and the acquisition unit specifies at least one of collusion groups which form the symbol sequences extracted from the legal copies, and determines at least one of the identification information items embedded in the legal copies based on at least one collusion group, the collusion groups being each formed of a combination of identification information items assigned to a number of legal copies not larger than the maximum number of legal copies.

20. (Original) The digital watermark analysis apparatus according to claim 19, wherein if only one of the collusion groups is specified, the acquisition unit specifies all identification information items forming the one collusion group, as the identification information items embedded in the legal copies.

21. (Original) The digital watermark analysis apparatus according to claim 19, wherein if a plurality of groups not less than two collusion groups are specified, the acquisition unit specifies only common identification information of the collusion groups as identification information embedded in the legal copies.

22. (Currently Amended) ~~The digital watermark analysis apparatus according to claim 10,~~ A digital watermark analysis apparatus for specifying at least one of a plurality of identification information items embedded as a plurality of watermark information items in a plurality of legal copies of digital contents used for collusive attacks, from a plurality of illegal copies of the digital contents obtained by collusive attacks made against the legal copies, the digital watermark analysis apparatus comprising:

an extraction unit configured to extract a plurality of embedded codes including ranks from the illegal copies, each of the ranks being uniquely numbered among each of the embedded codes;

an acquisition unit configured to acquire a plurality of symbols corresponding to the embedded codes and arrange the symbols in accordance with the ranks of the embedded codes, and acquire a first symbol sequence of symbol sequences each of which includes a plurality of the symbols; and

a specifying unit configured to specify at least one of the identification information items embedded in the legal copies, based on a plurality of second symbol sequences uniquely assigned to the identification information items and the first symbol sequence,

wherein a range of an identification information amount which is embedded as watermark information into the legal copies is set narrower than a range of an identification information amount to which the symbol sequences is assigned.

23. (Currently Amended) ~~The digital watermark analysis apparatus according to claim 10,~~ A digital watermark analysis apparatus for specifying at least one of a plurality of identification information items embedded as a plurality of watermark information items in a plurality of legal copies of digital contents used for collusive attacks, from a plurality of

illegal copies of the digital contents obtained by collusive attacks made against the legal copies, the digital watermark analysis apparatus comprising:

an extraction unit configured to extract a plurality of embedded codes including ranks from the illegal copies, each of the ranks being uniquely numbered among each of the embedded codes;

an acquisition unit configured to acquire a plurality of symbols corresponding to the embedded codes and arrange the symbols in accordance with the ranks of the embedded codes, and acquire a first symbol sequence of symbol sequences each of which includes a plurality of the symbols; and

a specifying unit configured to specify at least one of the identification information items embedded in the legal copies, based on a plurality of second symbol sequences uniquely assigned to the identification information items and the first symbol sequence,

wherein the identification information items include unique information assigned to users who provide the legal copies.

24-27. (Canceled)